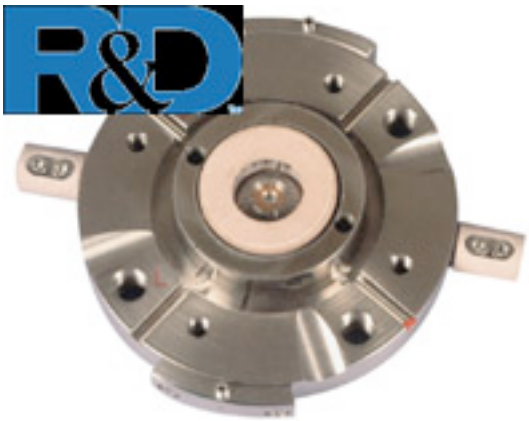
LAWRENCE LIVERMORE
REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory, Aug. 9-13, 2010

Diamonds reveal shocking discovery



The diamond anvil cell is small enough to fit in the palm of one's hand.

At first, nanoshocks may seem like something to describe the millions of aftershocks of a large earthquake.

But Laboratory physicists are using an ultra-fast laser-based technique they dubbed "nanoshocks" for something entirely different. In fact, the "nanoshocks" have such a small spatial scale that scientists can use them to study shock behavior in tiny samples such as thin films or other systems with microscopic dimensions (a few tens of micrometers). In particular, they have used the technique to shock materials under high static pressure in a diamond anvil cell (DAC).

Using a DAC, which probes the behavior of materials under ultra-high pressures (and which requires small samples), the team statically compressed a sample of argon up to 78,000 atmospheres of pressure and then further shock compressed it up to a total of 280,000 atmospheres. They analyzed the propagating shock waves using an ultra-fast interferometric technique. They achieved combinations of pressures, temperatures and time scales that are otherwise inaccessible.

In some experiments they observed a metastable argon state that may have been superheated -- a state at a pressure and temperature at which argon would normally be liquid, but because of the ultra-short time scale, does not have enough time to melt.

For more, go to http://www.rdmag.com/News/2010/07/General-Science-Physics-Diamond-Anvil-Cell-Experiments-Result-In-Shocking-Discovery/

Now you see it

Working with the dynamic transmission electron microscope (DTEM), from left are Bryan Reed, Melissa Santala, William DeHope, Thomas LaGrange and Joseph McKeown.

Scientists are peering into the heart of scientific phenomena while it's happening at Lawrence Livermore.

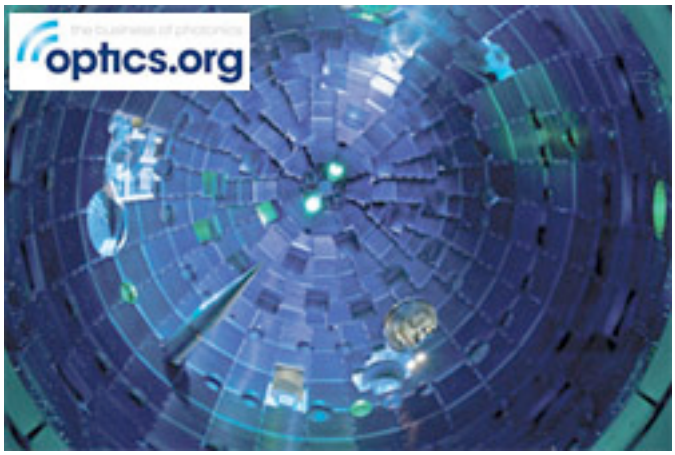
The team that built the dynamic transmission electron microscope (DTEM) is creating images of reactions moving at greater than 10 meters per second, with a few nanometers spatial resolution.

Unlike traditional transmission electron microscopes that are generally restricted to capturing images before and after some rapid transformation (such as a material deforming or the growth of a nanowire), the DTEM captures images during the process itself. DTEM goes beyond merely revealing that a transformation has happened; it provides crucial details of how, when and where it happened.

The DTEM is able to take snapshots of the dynamics that occur in samples of material under strenuous conditions -- extreme temperature, applied pressure, surface corrosion – creating a visual record of microstructural features as they rapidly evolve.

To read more, go to http://www.nanotechwire.com/news.asp?nid=10159

From fusion comes LIFE



The National Ignition Facility target chamber.

''Inertial confinement fusion has arrived'' and the National Ignition Facility is ''on the verge of working. ''

That was the message from Ed Moses, principal associate director at the National Ignition Facility (NIF) in an opening plenary session at the recent SPIE Optics & Photonics conference.

While the scope of the NIF project does not include any commercial energy production, Moses stated that with some improvements to key optical technologies in use at NIF, a commercial version of the concept could be ready by 2030. This idea has been dubbed laser inertial fusion energy or "LIFE. "

In essence, a LIFE power plant would be just like NIF, except that the pulse repetition rate of the lasers is ramped up to 10 or 15 Hz. At that rate, the heat produced could be used to drive a turbine in the conventional manner of a power station. A LIFE plant on the scale of NIF could power around a million homes, Moses believes.

To learn more, go to http://www.optics.org/news/1/3/1

To the galaxy and beyond

The Hubble Space Telescope image of the 320 million-light-year distant Coma Cluster Image: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)/K. Cook (Lawrence Livermore National Laboratory).

The Coma Cluster is home to nearly 1,000 galaxies, but the face-on galaxy NGC 4911 takes center stage in this scene. Thick with gas and dust, its outermost skeletal arms sport joints of intense star-formation regions.

"We think that the apparent 'kinks' are due to an interaction between the galaxy disc and the wider intracluster medium (hot X-ray gas) of the Coma Cluster," explains LLNL scientist Michael Gregg , who has a joint appointment at UC Davis.

Regions of star formation are revealed as NGC4911 travels at high speed through the cluster, and as the hotter gas of the intracluster medium rips away the cooler material of the galaxy's disc.

To read more, go to http://www.astronomynow.com/news/n1008/11galaxy/

Lab earns two technology transfer awards

Chris Melançon is pictured with a prototype of the Environmental Sample Processor (ESP).
Image: Spyglass Biosecurity Inc.

A Lab partnership that developed an environmental sampler that allows researchers to conduct biological analyses remotely in real time and a Lab technology that can detect more than 2,000 viruses and 900 bacteria in 24 hours each have garnered a technology transfer award in the Federal Laboratory Consortium's Far West Region competition.

Lab scientists and engineers, in tandem with Industrial Partnerships Office (IPO) employees, captured one outstanding partnership award for the Environmental Sampler Processor and one outstanding technology development honor for the Lawrence Livermore Microbial Detection Array (LLMDA).

The outstanding partnership prize went to Laboratory scientists who worked in conjunction with researchers at the Monterey Bay Aquarium Research Institute (MBARI), NOAA/National Ocean Service Marine Biotoxins Laboratory and partners comprising the Center for Microbial Oceanography Research and Education for MBARI's Environmental Sample Processor (ESP).

The outstanding technology award went to the LLMDA, which has shown value for applications in detecting bioterrorism events, product safety and diagnostics.

To read more, go to https://newsline.llnl.gov/_rev02/articles/2010/aug/08.06.10-flc.php

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high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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The *Livermore Lab Report* archive is available at:
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